COMPAS: COllaborative process Mining with robotic Process automation and generative AI for the design and Sustainability of hyper-connected processes

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Abstract. *Process Mining (PM) provides techniques for analyzing event logs to support evidence-based improvement and process discovery. However, multi-organizational collaborative processes remain difficult to design and analyze due to their distributed nature and technological diversity. Recent advances in Large Language Models and Robotic Process Automation offer new opportunities to support process discovery, modeling, and automation. In parallel, Green BPM emphasizes the need to incorporate sustainability considerations into process design and execution. This project aims to define and evaluate techniques, algorithms, methodologies, and strategies for integrating PM with RPA and Generative AI, considering sustainability elements for the design, automation, and analysis of hyper-connected collaborative processes for e-Government, leveraging real data from the Uruguayan Digital Government Agency (AGESIC), linking theoretical and practical results.*

1. Introduction

Business processes (BPs) [Dumas et al. 2018] define the set of activities performed in coordination within an organizational and technical environment to achieve a business objective. Process mining (PM) [van der Aalst 2016] offers techniques for analyzing event log data from process executions to support process model discovery and analysis, providing organizations with valuable information for evidence-based improvement. In the context of collaborative business processes, i.e., involving two or more organizations acting coordinately to carry out different parts of the process through message exchange, PM poses several challenges primarily due to the distributed execution and the heterogeneity of technologies and infrastructures.

In recent years, artificial intelligence (AI) has broken into all areas, promoting the integration of new automation and data analysis approaches, such as machine learning for predicting future events, or the use of Large Language Models (LLMs) to assist in

various tasks, e.g., process modeling, automation identification or the analysis of process execution traces [Grohs et al. 2024, Berti et al. 2024]. Moreover, Robotic Process Automation (RPA) [van der Aalst et al. 2018] has evolved over the last decade as a process improvement approach, leveraging software agents to perform tasks typically performed by humans [Dumas et al. 2026]. Given that the identification of which tasks to automate with RPA presents various challenges, PM, together with the use of LLMs, can provide key elements for their definition [Dumas et al. 2022, Jongeling et al. 2023].

Likewise, organizations have become increasingly aware of the need to achieve sustainable business processes, based on information technology, that are successful in their economies and in their ecological and social impacts. In this context, Green BPM [Hernández González et al. 2019] refers to the modeling, implementation, optimization, and management of business processes with special consideration for environmental consequences. Considering sustainability elements in the definition and automation of processes adds a new dimension of complexity that must be taken into account from the requirements and modeling stage to introduce specific elements that allow reducing the impact of their execution, for example, in energy consumption.

2. Project objectives and research method

The main objective of this project is to define and evaluate techniques, algorithms, methodologies, and strategies for integrating PM with RPA and Generative AI, with a focus on process discovery and modeling during the requirements stage. The approach incorporates sustainability considerations into the design, automation, and analysis of hyper-connected collaborative e-Government processes, leveraging real data from the Uruguayan Digital Government Agency (AGESIC) and linking theoretical and practical results. The project aims to reduce modeling effort, improve process execution and sustainability, and close the gap between process models and their execution. It seeks to support connected organizations through collaborative processes and services, thereby maximizing process productivity by reducing time and improving execution flows.

To conduct the research, we follow research methodologies such as systematic literature reviews [Kitchenham 2004, Kitchenham and Charters 2007] for the state of the art, which provide a rigorous method for identifying relevant literature on the defined topics. For each research topic, we follow the Design Science Research (DSR) methodology, which is research-oriented and addresses unsolved problems, thereby contributing to the creation of new knowledge in the foundations (theories, frameworks, models, etc.), methodologies, and applications. To evaluate the utility of the generated artifacts, we conduct case studies, controlled experiments, prototype development, and expert surveys [Yin 2017, Wohlin et al. 2024].

3. Beneficiaries

The project integrates researchers from the BPM, PM, and SE communities across universities and countries, including Uruguay, Spain, Italy, Germany, and the Netherlands, to disseminate results across multiple venues. At the national level, the Uruguayan Digital Government Agency (AGESIC) serves as a partner, providing empirical data from collaborative BP execution, models, and requirements for process automation, sustainability, and improvement. They also provide opportunities for case studies, experimentation, and

validation of the proposals, carrying out pilot applications with selected processes, allowing results to be generalized to organizations within this context.

4. Proposal overview and results obtained

To achieve the project's objectives, we have generated and evaluated several artifacts related to the defined research topics, along with associated publications and those in progress/evaluation. In Figure 1 we present the COMPAS project overview.

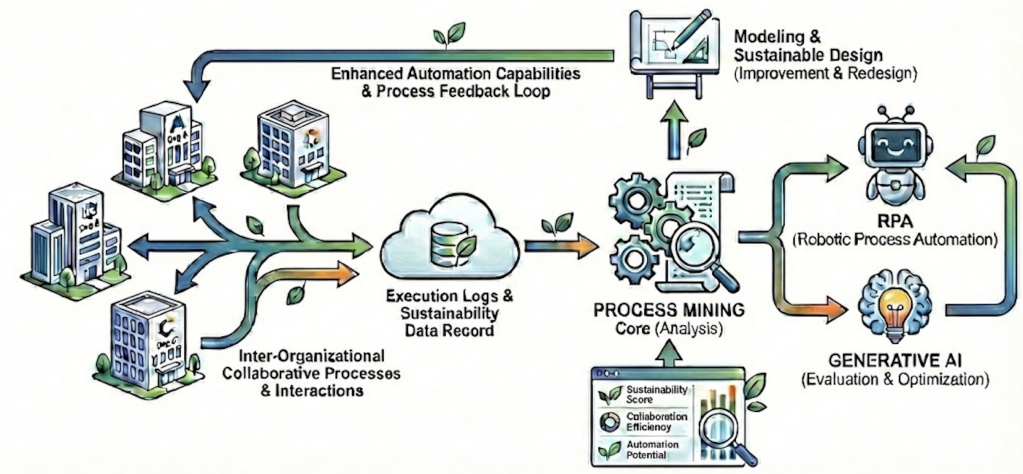

Figure 1. COMPAS project overview

We have conducted a systematic literature review on sustainability proposals in the context of PM and AI. We are currently working on the systematization of the content of primary studies and articles. We have also defined a sustainability-aware PM approach [Rubio et al. 2026], in which we defined an architecture with modules for: registering sustainability data within event logs with a sustainability extension for the XES format and a measurement taxonomy, sustainability measures calculation with a micro-services based module, and a dashboard to provide sustainability measures results to users. We have conducted an initial evaluation of the dashboard through a survey of experts on key sustainability elements for BPs, which is currently being processed.

Regarding RPA, we have defined a specific evaluation methodology for RPA tools, extending a previously defined one for BPMS platforms, in which we surveyed existing RPA tools and evaluated selected ones [Giaccio et al. 2026]. We also conducted a practical evaluation of selected RPA tools and their integration with BPMS platforms to enhance process automation capabilities in organizations. We have experimented with the support of LLMs for RPA, PM, and sustainability tasks for collaborative BPs and object-centric event logs. As part of the project, we hosted the 7th International Conference on Process Mining (ICPM 2025)(`https://icpmconference.org/2025/`) Montevideo, Uruguay, with authors serving as general and program chairs, also chairing several workshops on the research lines of the project, with participation of international and Latin American researchers, as well as AGESIC and the local software industry.

As part of ongoing research, we are extending the sustainability approach to integrate additional measures, translating the XES extension to object-centric event logs, improving tool support, and developing new tools for RPA and LLM integration. We are

also working on integrating the different lines within the COMPAS framework and on defining further experimentation and evaluation of the proposal with AGESIC.

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